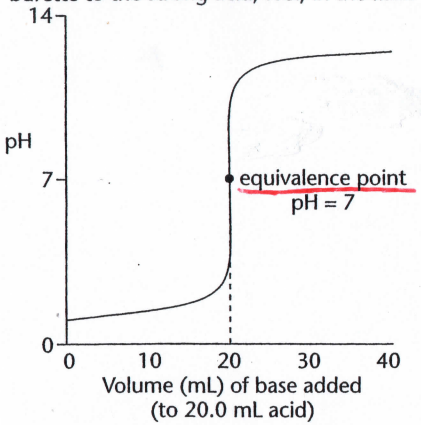
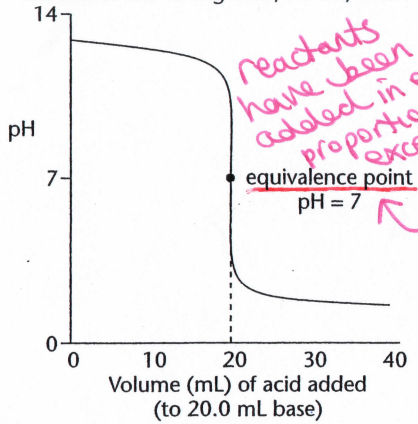
Adding the strong base, NaOH, from the burette to the strong acid, HCl, in the flask



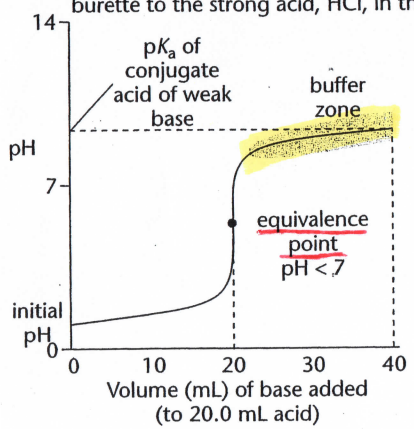
Adding the strong acid, HCl, from the burette to the strong base, NaOH, in the flask



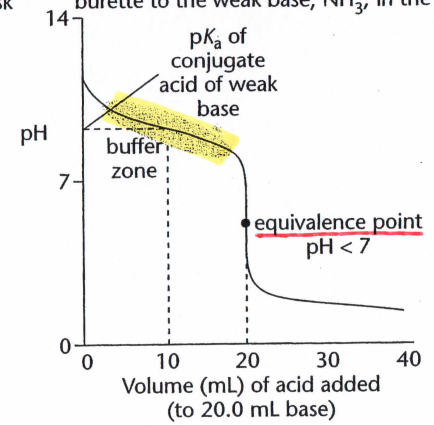
reactants have been added in equivalent proportions so no excess of either

bromothymol blue 6.0–7.6 yellow → blue

Adding the weak base, NH_3, from the burette to the strong acid, HCl, in the flask

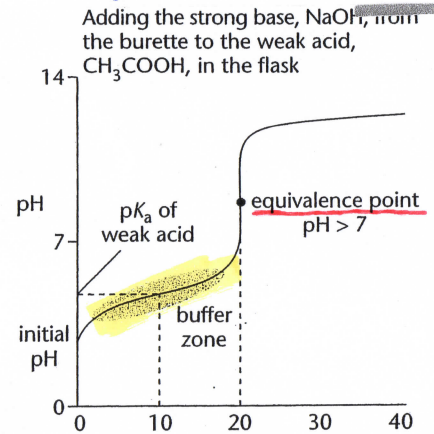


Adding the strong acid, HCl, from the burette to the weak base, NH_3, in the flask

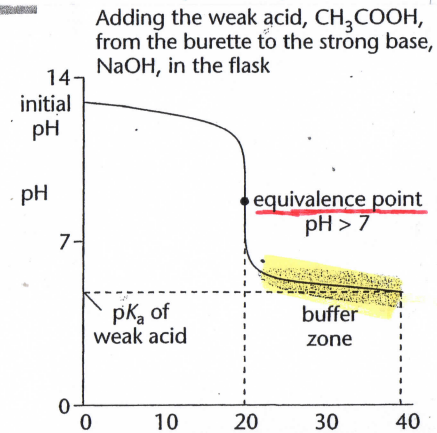


methyl orange 3.2–4.4 red → yellow

Adding the strong base, NaOH, from the burette to the weak acid, CH_3COOH, in the flask



Adding the weak acid, CH_3COOH, from the burette to the strong base, NaOH, in the flask



phenolphthalein 8.2–10.0 colourless → pink

20ml of 0.0750 molL^{-1} HCOOH is titrated against 0.1 molL^{-1} NaOH. Draw the titration curve for this titration upto a total of 25ml of NaOH added

$pK_a(HCOOH) = 3.74$

① the pH before any NaOH is added

$HCOOH_{(aq)} + H_2O_{(l)} \rightleftharpoons HCOO^-_{(aq)} + H_3O^+_{(aq)}$

$K_a = \frac{[HCOO^-][H_3O^+]}{[HCOOH]} = \text{invlog}\,-3.74 = 1.82 \times 10^{-4}$ assume!

$[HCOOH] = \text{conc}$

$1.82\times10^{-4} = \frac{x^2}{[HCOOH]} \Rightarrow \sqrt{(1.82\times10^{-4})(0.0750)} = x = 3.69\times10^{-3}$

$pH = -\log(3.69\times10^{-3}) = 2.43$

② the volume of NaOH at the equivalence point

$HCOOH_{(aq)} + NaOH_{(aq)} \rightarrow HCOONa_{(aq)} + H_2O_{(l)}$

$C = 0.075$ molL^{-1}, $V = 0.020$ L, $n = 1.5\times10^{-3}$

$C = 0.1$ molL^{-1}, $V = ?$ 0.015 L, $n = 1.5\times10^{-3}$

③ the volume of NaOH when **pH = pKa**

vol of NaOH at equivalence point = 15ml

half that volume is 7.5ml

④ the pH at the equivalence point

V of HCOONa = 20ml + 15ml = 35ml

n of HCOONa = 1.5×10^{-3}

$C = \frac{n}{V}$

$C = 0.0429$ molL^{-1}

$HCOO^-_{(aq)} + H_2O \rightleftharpoons HCOOH_{(aq)} + OH^-_{(aq)}$

$K_b = \frac{[HCOOH][OH^-]}{[HCOO^-]} = \frac{1\times10^{-14}}{1.82\times10^{-4}} = 5.49\times10^{-11}$

$[HCOO^-] = 0.0429$

$5.49\times10^{-11} = \frac{[OH]^2}{0.0429\ \text{mol}L^{-1}} \Rightarrow \sqrt{(5.49\times10^{-11})(0.0429)} = x$

$[H_3O^+] \quad \frac{K_w}{[OH^-]} = \frac{(1\times10^{-14})}{(1.54\times10^{-6})} = 6.49\times10^{-9}$ $pH = -\log(6.49\times10^{-9}) = 8.19$ 1.54×10^{-6} molL^{-1}

⑤ Calculate the pH after 25ml of NaOH added

total volume = 20 + 25 = 45ml

$C(NaOH) = \frac{10}{45} \times 0.1$

$= 0.0222$ molL^{-1}

$pOH = -\log[0.0222\ \text{mol}L^{-1}]$

$= 1.65$

assume $[OH^-] = C(NaOH) = 0.0222$

$pH = 12.3$